

## **VARROA MITES**

### Detection and Control Strategies

Varroa mites (***Varroa destructor***, formerly *Varroa jacobsoni*) were detected in Vermont in 1992. The numbers of mites found in some colonies indicated an original infestation occurring 2 or 3 years earlier. Since being detected in Addison and Rutland counties, varroa mites have spread to all areas of the State. It usually takes about 2 years for the mite levels in a colony to build to the point of colony collapse. This depends on the number of mites introduced into the colony at the time of initial infestation. There have been reports of colonies dying in one season from varroa. One point is certain: If your colonies are infested with varroa mites, they will eventually die.

Varroa mites present a new challenge to keeping bees in Vermont, as well as the rest of the country. To survive, beekeepers are going to have to be more informed on what is happening in the beekeeping industry, at both the national and state level, bee research, and in your own colonies. Additionally, beekeepers are going to have to learn about and embrace the concepts and principles of Integrated Pest Management, or IPM. This approach uses all the methods available, such as genetics, cultural/management practices, pest monitoring, and the judicious use of pesticides, to reduce a pest population to a tolerable level.

The most important part of a successful IPM program is pest detection. Looking for varroa mites in your colonies is going to have to be made a part of your routine, just as lighting a smoker. Fortunately, varroa mites are relatively easy to spot. They are reddish-brown in color, flat, oval shaped, about the size of a pin head. Varroa mites can sometimes be seen on adult bees. Look for them on the bee's thorax (back) or partially hidden between segments of the abdomen, especially on the underside. If the infestation is heavy, you may see newly emerged workers with deformed wings and shrunken abdomens.

When female mites are ready to lay eggs, they move into brood cells containing young larvae just before the cells are capped. They go to the bottom of the brood cells and immerse themselves in the remaining brood food. After the cells are capped and the larvae have finished spinning cocoons, the mites start feeding on the larvae. They begin laying eggs about three days after the cell has been capped. A fertilized female mite lays a total of 4 to 6 eggs. The adult female and its immature offspring feed and develop on the bee as it matures.

The varroa mite life cycle consists of four developmental stages: egg, two eight-legged nymphal stages (protonymph and deutonymph), and the adult. The period from egg to adult takes about 6 to 7 days for the female and 5 to 6 days for the male. Mating occurs in the brood cells before the new adult females emerge. The adult males die after copulation since their mouth parts are modified for sperm transfer rather than feeding. The old female and the newly-fertilized female off-spring remain in the brood cell until the young bee emerges. The adult bee serves as an intermediate host and a means of transport for these female mites.

Individual developing bees, if infested with one to two adult mites (and offspring), usually emerge without visible damage and are normal in appearance. They may, however, suffer from malnutrition, blood loss, or disease. Individuals that are heavily-infested with more than a few adult mites (which produce as many as 20 nymphs) usually become visibly crippled or die in their cells without emerging. In addition to the loss of hemolymph (blood), varroa mites are known to transmit a number of pathogens including several viruses.

When adult bees are infested with two or more mites, they become restless and fly with difficulty. Their life span is generally shorter than unparasitized bees and they perform tasks poorly. On a colony level, the symptoms of a varroa mite infestation depend upon the degree of infestation. Low-level varroa infestations are difficult to detect. Medium to high level infestations may result in the appearance of a spotty brood pattern, as well as the presence of malformed worker and drone adults with deformed wings (this may be associated with ■deformed wing virus•) and small, or shrunken abdomens. Such bees are often unable to fly and can be seen crawling. Bees will uncap and throw out infested brood, which can sometimes be found at the hive entrance. Parasitized pupae will appear to have small, pale or dark-reddish brown spots on their normal white bodies. Colonies become severely debilitated as mite populations reach extremely high levels at the end of the brood rearing season.

In some cases, symptoms resembling a cross between foulbrood and sacbrood are observed in the brood nest. The USDA Bee Research Lab has found these diseased larvae to be infected with one, or commonly several, viruses. This condition seems to be limited to colonies infested with varroa mites. Also, beekeepers have had bees disappear completely from previously healthy looking colonies in the fall. This situation most likely is associated with varroa mites, viruses, or a combination of both. This complex of symptoms has been given the name ■Parasitic Mite Syndrome•, or PMS.

Affected larvae die in the late larval or prepupal stage, stretched out in their cells often with their heads slightly raised. In the early stage of infection, they are white but dull rather than glistening, and they look deflated. Later, the larva may have gray or brownish spots. Prepupa die after the cell has been capped, and the cappings may be perforated or completely removed by the bees. The appearance of the brood pattern is often scattered, with many voids. When the larval remains are stirred with a small twig, they do not ■rope out• (like with AFB), but are ■clumpy• or ■globular• (similar to EFB).

Varroa mites are more readily detected on bee brood, particularly drone brood. Using a capping scratcher, remove drone pupae and watch for mites moving around on them, and watch the now empty cells for mites. Also pay close attention to the drone brood in burr comb that is exposed when breaking apart hive bodies. If the infestation is heavy, or there are few drones being reared, then mites may be found in worker brood.

Another method of finding varroa mites is called the ether-roll test. Take a quart jar with lid, and gather about 250 bees from the brood nest, (bees will be about 1-2 inches deep in jar), being careful not to get the queen. A small paint brush works well. Spray a two second blast of ether (commonly sold as starting fluid for cold engines) into the jar and close

immediately. Shake the jar vigorously, and carefully watch the inside surfaces of the jar, as you slowly rotate it. Any mites will be stuck in the thin film of moisture on the inside of the jar. Wash jar between tests. Be very careful not to breathe the ether fumes, or spray too close to a lit smoker - ether is very flammable. This method is fast, but not very accurate at detecting a low level infestation, and is lethal to the sampled bees.

A similar, non-lethal method of sampling adult bees is the "Powdered-Sugar Shake". This technique separates varroa mites from honey bees; as is the case for the ether roll, but the bees survive the procedure. There are several reasons why this method works. First, varroa mites have a sticky pad on their "feet" called the empodium that helps them adhere to their host. The presence of powdered sugar could make it difficult for the mites to adhere to their host. Second, powdered sugar stimulates the bees' grooming behavior. Third, the powdered sugar on the mite's body stimulates mites to release from feeding to groom themselves.

To use this technique, one needs the following:

1. A wide-mouth canning jar with two-piece lid.
2. #8 mesh hardware cloth (or any other mesh that will retain the bees while letting varroa to pass through).
3. Window screen or any other fine mesh hardware cloth that will let the sugar pass through but retain the varroa.
4. Small container, such as a plastic margarine tub.

Cut the #8 mesh screen to replace the circular, center portion of the lid. Collect about 250 bees in the jar (about 1-2 inches deep), from the brood nest area. A funnel can be used to facilitate the process. Replace the modified lid and add about a tablespoon of powdered sugar through the screen. Roll the jar to distribute the sugar. Wait a few minutes, swirl the jar again, and pour the sugar and mites through the screen into the smaller margarine container. Now cover the smaller container with the window screen and shake the sugar out, leaving any mites in the container. The bees can be returned to the colony where their hive mates will lick them clean. This method will separate up to 90% of the mites from the bees.

An additional method uses a detector board. This board, cardboard or heavy paper, is coated with a thin film of vegetable oil, such as Pam, and covered with 8 mesh hardware cloth, and placed on the bottom board for a period of time. As the mites naturally die off, or fall off the bees, they fall to the detection board and are caught on the surface in the oil film. The screen prevents the bees from getting trapped on the oily surface or removing the dead mites. Leave this board on for several days, then inspect for mites. The longer this board is left on, the more likely it is to collect any mites, but it also will collect more hive debris, making it difficult to find the mites. An inexpensive magnifying glass is very helpful in locating and identifying the mites.

Again, detection is the first step in controlling varroa mites. Do not treat unless you have detected mites. Remember: never place acaricides (pesticides that kill mites) in colonies during marketable nectar flows. Check all colonies early enough in the season, so if large

numbers of mites are found, treatment can be completed before the honey flow.

If fall treatment is needed, try to place control materials in hives by late August, after removing all honey supers. This will help protect the last several brood cycles from the mites, which is important because these bees will become the winter and spring bees. (Most colonies in Vermont will require a fall treatment. The only exception may be package colonies started in the spring, which should have been treated before or during shipment. Research and testing is ongoing to develop methods of controlling varroa mites with the goal of reducing or eliminating the reliance on "hard chemicals". There is now a promising control program based on IPM emerging. This program brings together several elements including varroa tolerant stock, screened bottom boards, and drone comb varroa "traps". The USDA has released several new lines of bees into commercial production, developed from varroa tolerant stock brought to the USA from Russia. After several years of isolation and testing, this stock has shown tolerance to varroa mites as well as having other traits considered necessary to be a viable bee stock. Several queen breeders are also working to develop hygienic stock, bees that consistently remove a high percentage of varroa infested and/or diseased larvae. These stocks are available now on a limited basis, and should become more commonplace as breeders incorporate these strains into their own systems. Check the bee journals for availability.

Screened bottom boards (see the bee equipment supply catalogs), are basically a rim of wood covered with 8 mesh screen. It was recently discovered that upwards of 40% of varroa mites fall off of adult bees. In a regular hive situation, these fallen mites simply fall to the bottom board and wait for a passing bee to come by and reattach, or crawl back to the bee cluster. However, if they fall through a screen and are separated by about 2 inches from the bees, they just sit still, and eventually starve, since they are too far to sense the presence of bees, and therefore do not move. While this method by itself would not stop a total collapse of the bees due to varroa, it will significantly reduce the varroa population.

Drone comb is another part of the program. It is well documented that varroa mites prefer drone brood over worker brood for the raising of their young, primarily due to the longer development time of the drones. By placing specially manufactured drone foundation, which the bees will draw into drone comb, a significant number of varroa mites can be trapped. For this to work at the most efficient level, there must not be much other drone comb in the brood nest. By placing the special drone comb into the brood nest, the varroa will be attracted to the developing larvae and quickly infest this comb. Once the drone brood is sealed, the comb can be removed from the colony, placed in a plastic bag, and placed in a freezer. After the comb is well frozen, it can be removed from the freezer, allowed to thaw, then the cappings on the brood can be opened with a cappings scratcher. When this comb is placed back in the colony, the bees will begin to remove the dead varroa and drone brood. For a two story brood nest, it may be necessary to have two or more "drone trap combs" to make sure the varroa always have some open drone brood to search out.

As can be seen from the previous discussion, IPM programs are much more labor

intensive. Research is ongoing to further refine this approach to varroa management. While not an ideal management program for a large, commercial operation, most hobby beekeepers should be able to implement such an IPM program, with planning and attention to detail.

At the present time, there are five products approved by the EPA and the Vermont Agency of Agriculture for use in bee hives. They are ***Apiguard, Apistan, APILIFE VAR, Mite-Away II***, and ***Sucroside***.

For detailed descriptions, directions, precautions and restrictions on the above mentioned products, please visit the apiary page at the Vermont Agency of Agriculture website. Go to [www.vermontagriculture.com](http://www.vermontagriculture.com), and on the home page, select ■Subject Index•, scroll down on the ■A• list to ■Apiary Information and Registration•. You should now be at the apiary page. In the ■Update• section, there will be links to the specific labels of the products mentioned above.

Do not use different varroa control products at the same time in hives. It is unknown if any adverse effects would occur if this was done. Monitor your hives for varroa levels throughout the season to see if you have a varroa problem. Treat only if needed. **READ AND FOLLOW ALL LABEL DIRECTIONS!**

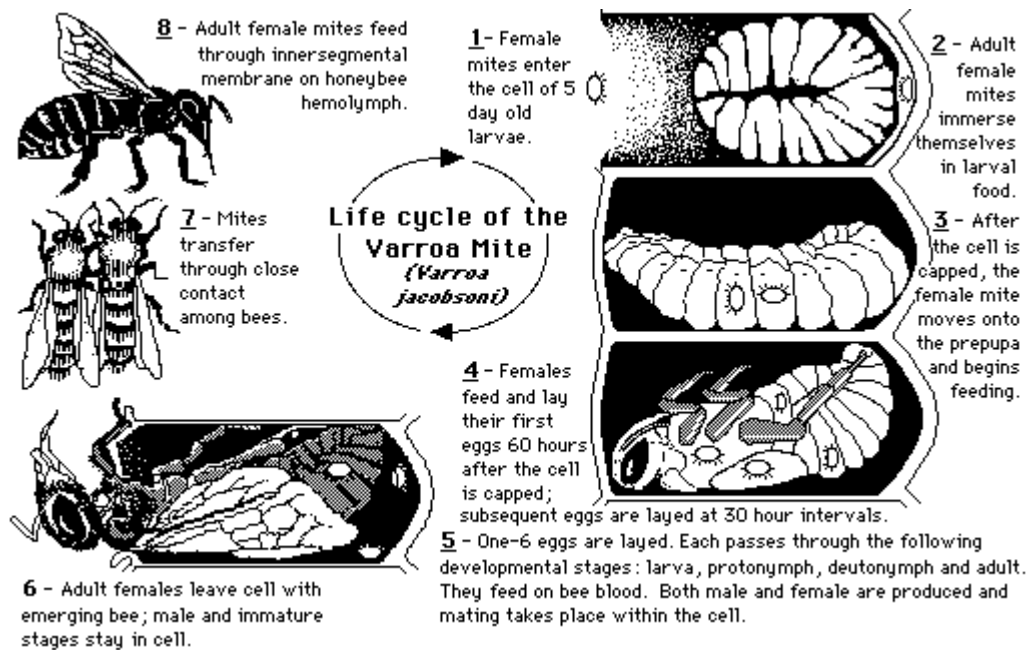
When used properly, these acaricides will provide adequate and safe control of varroa mites. It is important to note however, that not necessarily all of the mites will be killed by an application of any of these materials. Be looking for mites next season, and be prepared to treat again. In some cases, treatment twice yearly may be required. In order to reduce the chances of varroa mites developing resistance to chemical controls, it is often advisable to alternate treatment materials.

All beekeepers must act responsibly when using these products to control varroa mites, to avoid the possibility of honey contamination. We must do all we can to maintain the purity of our product and the safety to consumers. It will not take many reports of contaminated honey to seriously threaten our industry, and cast a shadow on honey as a wholesome, "natural" product. Now, more than ever, beekeepers are going to have to pay more attention to their bees, the beekeeping industry, and the concerns of the consumer.

**THE VERMONT AGENCY OF AGRICULTURE IS REQUIRED TO MONITOR AND ENFORCE THE USE OF THESE PRODUCTS IN ACCORDANCE WITH THEIR LABELS. MISUSE OF THESE PRODUCTS MAY RESULT IN FINES OR OTHER ADMINISTRATIVE ACTIONS. IF UNSURE OF PROPER USE, CALL THE VERMONT AGENCY OF AGRICULTURE OR THE MANUFACTURER PRIOR TO USE.**

If you have any questions, contact the State Apiculturist, at the Vermont Agency of

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Portions of this leaflet are borrowed from the publication ■VARROA MITES■, by the Mid-Atlantic Apicultural Research & Extension Consortium, MAAREC Publication 4.7, February 2000. Also see [www.ento.psu.edu/MAAREC/index.html](http://www.ento.psu.edu/MAAREC/index.html).

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